Claims:

1. A reactor vessel, for generating hydrogen from a hydride solution in presence of a catalyst, the reactor vessel comprising:

a) at least one reaction chamber and at least one coolant chamber, each reaction chamber being configured to receive the hydride solution and to bring at least a portion of the hydride solution in contact with the catalyst, each coolant chamber being configured to receive a coolant flow; and

b) at least one reactor plate having a first face and a second face in opposing relation with the first face, wherein the first face defines a portion of each reaction chamber and the second face defines a portion of one coolant chamber.

2. The reactor vessel of claim 1 , wherein the first face of each reactor plate defines a solution flow field therein and the second face defines a coolant flow field therein.

3. The reactor vessel of claim 2, wherein the solution flow field comprises a plurality of solution channels therein and the coolant flow field comprises a plurality of coolant channels.

4. The reactor vessel of claim 3, further comprising a catalyst located on at least a portion of the plurality of the solution channels.

5. The reactor vessel of claim 4, wherein the catalyst is in pellet form.

6. The reactor vessel of claim 3, wherein the reactor plate further comprises:

a) a solution inlet and a solution outlet defined in the first face, the solution inlet and the solution outlet being in fluid communication with the plurality of the solution channels; and

b) a coolant inlet and a coolant outlet defined in the second face, the coolant inlet and coolant outlet being in fluid communication with the plurality of the coolant channels.

7. The reactor vessel of claim 6, wherein the plurality of the solution channels extend from the solution inlet to the solution outlet, and the plurality of coolant channels extend from the coolant inlet to the coolant outlet.

8. The reactor vessel of claim 8, wherein the reactor plate is rectangular, the solution inlet and the solution outlet being located proximate to diagonal corners thereof, the coolant inlet and coolant outlet being located proximate to remaining diagonal corners thereof and wherein the solution inlet, the solution outlet, the coolant inlet and the coolant outlet all extend through the plate, for forming distribution ducts from a plurality of similar reactor plates stacked together.

9. The reactor vessel of claim 3, wherein the reactor vessel comprises a plurality of reactor vessel plates, and a plurality of separator plates alternating with one another, to define a plurality of reaction chambers alternating with a plurality of coolant chambers, each reaction chamber being in fluid communication with an adjacent one of the plurality of reaction chambers and each coolant chamber being in fluid communication with an adjacent coolant chamber.

10. The reactor vessel of claim 9, wherein each reactor plate defines a solution inlet port, a solution outlet port, a coolant inlet port and a coolant outlet port, all formed as openings extending therethrough, and wherein each separator plate includes openings providing inlets and outlets to the coolant and the solution aligned with the solution and coolant inlet and outlet ports, whereby distribution ducts are formed extending through the reactor plates and the separator plates to distribute both the solution and the coolant to the reaction and coolant chambers and to collect the solution and the coolant from the reaction and the coolant chambers.

11. The reactor vessel of claim 10, wherein the reactor plates and the separator plates are positioned in substantially parallel spaced relationship, thereby forming a stack of the plurality of reactor vessels, and wherein means are provided for clamping the reactor plates and the separator plates together.

12. The reactor plate of claim 8, wherein the solution channels are substantially parallel.

13. The reactor plate of claim 12, wherein the coolant channels are substantially parallel.

14. A reactor plate for a hydrogen generating reactor having a reaction chamber and a coolant chamber, the reactor plate comprising:

a) a first face defining at least a portion of the reaction chamber; and

b) an opposing second face defining at least a portion of the coolant chamber.

15. The reactor plate of claim 14, wherein said first face defines a solution flow field.

16. The reactor plate of 15, wherein the solution flow field comprises a plurality of solution channels.

17. The reactor plate of claim 16, further comprising a catalyst located on at least a portion of the plurality of the solution channels.

18. The reactor plate of claim 17, wherein the catalyst is in pellet form.

19. The reactor plate of claim 16, wherein the second face defines a coolant flow field having a plurality of coolant channels defined therein.

20. The reactor plate of claim 19, wherein the reactor plate further comprises:

a) a solution inlet and a solution outlet defined in the first face, the solution inlet and the solution outlet being in fluid communication with the plurality of the solution channels; and

b) a coolant inlet and a coolant outlet defined in the second face, the coolant inlet and coolant outlet being in fluid communication with the plurality of the coolant channels.

21. The reactor plate of claim 20, wherein the plurality of the solution channels extend from the solution inlet to the solution outlet, and the plurality of coolant channels extend from the coolant inlet to the coolant outlet.

22. The reactor plate of claim 21, wherein the reactor plate is rectangular, the solution inlet and the solution outlet being located proximate to diagonal corners thereof, the coolant inlet and coolant outlet being located proximate to remaining diagonal corners thereof and wherein the solution inlet, the solution outlet, the coolant inlet and the coolant outlet all extend through the plate, for forming distribution ducts from a plurality of similar reactor plates stacked together.

23. The reactor plate of claim 22, wherein the solution channels are substantially parallel.

24. The reactor plate of claim 23, wherein the coolant channels are substantially parallel.

25. A system for generating hydrogen from a hydride solution in presence of a catalyst, the system comprising:

a) a reactor vessel defining a reaction chamber and a coolant chamber, the reaction chamber being configured to bring at least a portion of the hydride solution in contact with the catalyst, the coolant chamber being located proximate to the reaction chamber for cooling of the hydride solution;

b) a solution supply means for delivering the hydride solution to the reaction chamber, the solution supply means being in fluid communication with the reaction chamber; and

c) a coolant supply means for delivering a coolant flow to the coolant chamber, the coolant supply means being in fluid communication with the coolant chamber;

wherein the coolant supply means is configured to control at least one of the flow rate and the temperature of the coolant flow through the coolant chamber, thereby improving control of the temperature of the hydride solution in the reaction chamber.

26. The system of claim 25, wherein the reactor vessel further comprises at least one reactor plate having a first face and a second face in opposing relation therewith, wherein the first face defines a portion of the reaction chamber and the second face defines a portion of the coolant chamber.

27. The system of claim 26, wherein the first face defines a solution inlet port, a solution outlet port, and a solution flow field in fluid communication with the solution inlet port and the solution outlet port.

28. The system of claim 27, wherein the solution flow field comprises a plurality of tortuous channels extending between the solution inlet port and the solution outlet port.

29. The system of claim 28, wherein the second face defines a coolant inlet port, a coolant outlet port, and a coolant flow field in fluid communication with the coolant inlet port and the coolant outlet port.

30. The system of claim 29, wherein the coolant flow field comprises a plurality of tortuous channels extending between the coolant inlet port and the coolant outlet port.

31. The system of claim 26, wherein the reactor vessel includes a plurality of reactor plates and a plurality of separator plates alternating with one another to form alternating reaction and coolant chambers, wherein each reactor plate has a solution inlet port, a solution outlet port, a coolant inlet port

and a coolant outlet port, all formed as openings extending therethrough, and wherein each separator plate includes openings providing inlets and outlets for the coolant and the solution aligned with the solution and coolant inlet and outlet ports, whereby distribution ducts are formed extending through the reactor plates and the separator plates to distribute both the solution and the coolant to the reaction and coolant chambers and to collect the solution and the coolant from the reaction and the coolant chambers.

32. A system for generating hydrogen from a hydride solution in presence of a catalyst, the system comprising:

a) a solution supply means for supplying the hydride solution;

b) a coolant supply means for supplying a coolant flow; and

c) a reactor vessel defining a reaction chamber and a coolant chamber, the reaction chamber being in fluid communication with the solution supply means, the reaction chamber being configured to bring at least a portion of the hydride solution received from the solution supply means in contact with the catalyst, the coolant chamber being in fluid communication with the coolant supply means; and

at least one reactor plate having a first face and a second face in opposing relation with the first face, wherein the first face defines a portion of the reaction chamber and the second face defines a portion of the coolant chamber.

33. The system of claim 32, wherein the coolant supply is configured to control at least one of the temperature and the flow rate of the coolant flow through the coolant chamber, thereby improving control of the temperature of the hydride solution in the reaction chamber.

34. A method of generating hydrogen comprising the steps of:

a) contacting a catalyst with a hydride solution; and

b) providing a coolant flow proximate to the hydride solution for controlling the temperature thereof;

c) controlling at least one of the temperature and the flow rate of the coolant flow to improve temperature control of the hydride solution in contact with the catalyst.